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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/960,479	09/24/2001	Mitsuo Tokuda	29284/548	5800

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EXAMINER

HUGHES, JAMES P

ART UNIT

PAPER NUMBER

2881

DATE MAILED: 01/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/960,479

Applicant(s)

TOKUDA ET AL.

Examiner

James P. Hughes

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☒ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3. 6) ☐ Other: .

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers filed under 35 U.S.C. 119 (a)-(d) based on an applications JP 2000-340387 and JP 2000-344226 filed in Japan on Nov. 2, 2000 and Nov. 7, 2000 respectively. However, applicant has not submitted a certified copy of JP 2001-049303, filed on Feb. 23, 2001. Priority over this document is claimed on the cover sheet of applicant's correspondence received on Sep. 24, 2001. A certified copy of the priority document must be provided to receive priority under 35 USC 119.

Specification

2. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). A "cover member" for protecting said needle member is claimed in line 14 of claim 16. The specification does not include a written description of the "cover member" or a concept representing the "cover member". Correction is required.

Claim Objections

3. Claim 5 is objected to because it is unclear as to whether the second sample stage is mounted on a plurality of minute samples, or the plurality of minute samples are mounted on the second sample stage, "a second sample stage capable of mounting on a plurality of minute samples conveyed by said moving mechanism" (lines 2-3). Appropriate correction is required.

Claim Rejections - 35 USC § 112

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The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

ok 4. Claim 16 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. A “cover member” for protecting said needle member is claimed in line 14 of claim 16. The specification does not include a written description of the “cover member” or of a concept representing the “cover member”.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

ok 5. Claim 16 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In lines 14-17 it is unclear as to what is disposed within a movement range of the sample stage, is it the “cover member” or the “needle member”?

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

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having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-9 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shofner (6,300,631) in view of Iwasaki et al. (5,525,806). Shofner teaches an apparatus and method of obtaining a minute sample from a sample. Shofner discloses a focused ion beam irradiation optical device (50) in a vacuum chamber (51) consisting of a focused ion beam (FIB), that emits an ion beam, that may be converged, focused, and scanned on a sample via lenses (54, 56) and deflector (64) for scanning the ion beam. (Col. 3, lines 1-67) A support (66) holds sample stage (68) for mounting a sample which may be a semiconductor wafer – with or without a pattern – or another sample, wherein the support (66) is connected to a movement system (68, 68a, 70, 71, 78, 80) that allows rotation and translation via movement in the X, Y, and Z direction in addition to various other axes. (Col. 3, lines 40-67) Shofner disclosed that a second focused ion beam device (ion beam with focusing and scanning equipment) could be mounted within the chamber (51) to allow emission of a focused ion beam at a different direction. (Col. 4, lines 11-14)

Shofner discloses an apparatus and method of imaging and fabricating a minute sample from a sample, which involves: placing the specimen on a sample stage (68), cutting the minute sample from the sample with the FIB device (50), and removing, and supporting, the minute sample with a probe – or needle member – (97), held by a probe holder (94). The probe (97) is controlled and operated by a mechanism (96), which may be connected to computer (78) and controller (80), that allows the probe to move and adjust the position and attitude of the minute sample, in which the minute sample may become substantially perpendicular to an optical axis of an additional focused ion beam device or other additional electron beam. This mechanism may

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also control an application angle of the ion beam or said an additional electron beam to the minute sample. The probe (97) may also move the minute sample to a grid (90), where the resulting minute sample held on grid (90) forms a membrane (M). Additionally, there is room for more than one minute sample on each grid (90). (Col. 4, line 31 - Col. 5, line 55) The probe (97), probe holder (94), and mechanism (96) may have a structure of slanting said probe holder (94) to a surface of said sample stage. (Fig. 4)

The minute sample membrane (M) is mounted on second sample stage (69), which is larger than a single membrane (M), and thus may hold a plurality of minute samples conveyed by the probe (97). (Col. 5, lines 20-60) The second sample stage (69) is mounted on the support (66) via sample stage (68) and thus connected to a movement system (68, 68a, 70, 71, 78, 80) that allows rotation and translation via movement in the X, Y, and Z direction in addition to various other axes. Following, this movement will allow control of an application angle of the ion beam or an additional electron beam. (Col. 3, lines 40-67)

Shofner also teaches that the FIB device (50) may include a secondary electron detector (76), computer (78), deflection system controller (80), and CRT (82) to form an image by a scanning ion microscope. (Col. 3, lines 56-64) However, Shofner does not teach a separate primary electron beam or an x-ray detection system.

Iwasaki et al. (5,525,806) teaches an apparatus and method using a focused ion beam and scanning electron microscope. The apparatus consists of an ion gun (1), an ion beam (2), which is turned to be focused ion beam (2) through accelerating, focusing, and scanning by an ion-optics systems, and is focused on a sample (4) on a sample stage. Additionally, said apparatus consists of an electron gun (6), an electron beam (7); which is accelerated, focused, and scanned

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by electron lens system, which includes an objective lens and deflector (8, 8a, 82); is irradiated onto the said sample (4). Iwasaki also teaches an x-ray detector (10), which detects x-rays from the sample (4) as it is irradiated by the electron beam (7). (Col. 3, line 22 – Col. 4, line 35)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the scanning electron microscope and x-ray detection system of Iwasaki et al. with the sample imaging and processing of Shofner because it would allow imaging and compositional analysis of the sample to be conducted independently and separately from where the ion beam is focused.

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shofner (6,300,631) in view of Iwasaki et al. (5,525,806) as applied to claim 8 above, and further in view of Moore et al. (6,420,722). Shofner in view of Iwasaki teaches a minute sample imaging and fabrication apparatus and device as described above in section 6. However, a tetrahedron or pentahedron minute sample is not taught.

Moore teaches a method for sample separation and lift-out where the minute sample that is cut from the sample is a pentahedron. (Fig. 4)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the pentahedron minute sample of Moore with the apparatus and device of Shofner in view of Iwasaki because as Moore teaches, there is a processing efficiency gained by cutting the minute sample in a pentahedron shape. (Col. 1, lines 60-68)

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8. Claims 12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohnishi et al. (5,270,552) in view of Masaru et al. (JP 2000-146780). Ohnishi teaches a method and apparatus for analyzing and separating a minute sample from a sample. Ohnishi teaches an application optical system for an ion source (100) which focuses an ion beam (1) on a sample – which may be a semiconductor wafer, with or without a pattern, or another type of sample – (2) through a condenser lens (101) and as objective lens (106), where the ion beam is scanned over said sample via a deflector (105). The sample (2) is mounted on sample stage (108), which is movable by a mechanism (108a). A secondary electron detector (109) detects secondary electrons produced from the sample (2) by irradiation of the ion beam (1). (Col. 5, lines 5-40) A probe – or needle member – (31) is attached to a probe holder (112) that is driven by a moving mechanism (112a) in a slanting structure toward the surface of the sample stage (108). (Col. 5, lines 40-55)

A computer (110) controls the stage moving mechanism (108a), probe/probe holder moving mechanism (112a), gas source control section (107a), etc., so that the computer controls the entire process. (Col. 5, lines 54-65)

The ion beam (1) may cut a minute sample (9) from the sample (2), where the minute sample (9) is attached to the probe (31). The sample is cut from ion beams directed from at least two different directions. The minute sample is attached to the probe (31) via forming a redeposition film of sputtering particles produced through the focused ion beam processing or through a beam induced deposition film formed by focused ion beam irradiation in a gas atmosphere. (Col. 6, lines 1-68)

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Ohnishi discloses that the ion beam focus area may be imaged in a scanning ion microscopic manner via the secondary electron detector (109). However, it is difficult to judge the contact between the probe (31) and the sample (2). Thus, probe may be to be electrically conductive and monitored to determine when contact with the sample (9) is made. Ohnishi teaches that this entire process is observed through an industry standard scanning electron microscope. (Col. 6, line 60 – Col. 7, line 22)

Ohnishi teaches that the minute sample (9) held by probe (31) may be inserted into various analyzing apparatus separately from the sample (2) so as to be measured independently. For example, element analysis can be performed through secondary ion mass spectroscopy (SIMS). Further, it is also possible to process the separated sample (9) again – immediately, while in the sample chamber – so as to have shape of a wedge sample to be analyzed by a CAT method, or a TEM sample, or another type of sample or analysis. (Col. 7, lines 25-45) Further, Ohnishi teaches that multiple TEM samples may be taken from a single sample and processed separately. Additionally the separation method taught allows a minute sample to be easily formed from a sample and moved into a desired portion of another sample. (Col. 7, line 64 – Col. 9, line 65)

Ohnishi is silent on the chamber and atmosphere in which the apparatus is enclosed. However, it is inherent in Focused Ion Beam processing or in processing an ion beam induced deposition film formed by focused ion beam irradiation in a gas atmosphere, that the apparatus is enclosed in a high to ultra-high vacuum chamber. Ohnishi is also silent on a cover member for protecting the probe (31). Official notice is taken that a protective covering member is commonly used to protect areas of an apparatus when sputtering or using an ion beam induced

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deposition. Ohnishi does not disclose a particular method or apparatus for inserting or extracting the minute sample(s) (9) or the sample (2) from the apparatus.

Masaru et al. (JP 2000-251820) teaches a probe – or needle member – and probe holder for handling minute samples in a vacuum chamber, wherein the probe holder may be introduced and extracted from the chamber independently with out bringing the chamber to atmospheric pressure. This probe is protected by cover member with a structure that may be inclined to a surface of a sample stage (78) (see the far right end of Fig. 7) that may be disposed within a movement range of the sample stage (78). Additional, Masaru teaches that two similar probes may be used (Fig. 9). Masaru discloses that this probe will increase the operation rate by shortening stopping time, thus allowing more efficient sample processing. (Abstract, lines 1-15)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the probe hold of Masaru with the method and apparatus for analyzing and separating a minute sample from a sample of Ohnishi because this would allow micro samples from a sample to be individually removed from the apparatus to be analyzed via other means than available in the apparatus without brining the whole apparatus in to contact with normal atmospheric conditions, thus increasing processing efficiency as disclosed by Masaru.

9. Claims 13, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohnishi et al. (5,270,552) in view of Masaru et al. (JP 2000-146780) as applied to claim 12 above, and further in view of Shofner (6,300,631). Ohnishi et al. (5,270,552) in view of Masaru et al. (JP 2000-146780) teach a method and apparatus for fabricating and analyzing a minute

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sample as described above in section 8. However they do not teach two focused ion beam devices or two probes and probe holders to remove a minute sample from a sample.

Shofner teaches an apparatus and method of obtaining a minute sample from a sample as described above in section 6. Further, Shofner teaches a probe of glass or similar material that may remove a minute sample from a sample via electrostatic forces. Additionally, Shofner teaches that a second focused ion beam device (ion beam with focusing and scanning equipment) may be mounted within the chamber (51) to allow a focused ion beam to be emitted at a different direction. Shofner also disclosed the option of using the movable/tiltable second sample holder (69) to reach the sample at various angles. (Col. 4, lines 11-14)

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the two focused ion beams and electrostatic probe of Shofner with the method and apparatus of Ohnishi in view of Masaru. One of ordinary skill would have been motivated to do so because: the two focused ion beams can increase the efficiency of sample fabrication process by reducing the need to move the sample to perform multiple cuts from different directions; and replacing the second probe taught by Masaru with the probe holder and probe that can move minute samples via electrostatic forces, which is commonly used when moving minute sample in a non-destructive manor as taught by Shofner, will provide additional processing options.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Tomimatsu (EP 0 927 880) teaches a method and apparatus for preparing samples, which includes a sample probe holder and probe for separating and moving minute samples that may be introduced and extracted from a vacuum chamber without brining the chamber to

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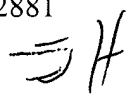
atmospheric pressure. (Col. 16, lines 34-45) Additionally, Tomimatsu teaches a second FIB (97) that is positioned at an angle to the sample stage (2). Libby et al. (6,039,000) teaches a focused particle beam system and method using a tilt column for FIB processing. (Fig. 5) Hosono (5,093,572) teaches a scanning electron microscope observation and cross sectioning method and apparatus wherein the SEM is aligned between 0 and 60 degrees relative to the sample surface for an efficient scanning process. Fischione (5,633,502) is an example of alternative processing methods used on TEM minute samples. Fischione teaches a plasma processing system for TEM minute samples.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to James P. Hughes whose telephone number is 703-305-5675. The examiner can normally be reached on Monday - Friday 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Lee can be reached on 703-308-4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1782.

James P. Hughes
Examiner
Art Unit 2881


December 30, 2002


JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800